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AEC-NASA TECH BRIEF

Mobility Monitoring System for Ecological Studies

The problem:

To develop a device for long-term monitoring of the locations of animals for ecological studies. Generally, telemetering systems are used.

The solution:

A radioactive-nuclide system automatically monitors animals in the field, using radioactive tracers affixed to the animals, Geiger-Muller (GM) tube radiation detectors, and event-recorders (1). Four animals can be monitored simultaneously within a 32-m circle, with each animal as far as 1 m from its associated detector. A permanent record covers 1 week on an event-recorder chart.

When residence time at a particular location is to be monitored, the radioactive-nuclide method has certain distinct advantages over telemetering systems. Since the "transmitter" is nuclear rather than electronic, it is inexpensive, very small, and free of maintenance and battery-life problems; since there are no tuned circuits or antennas, the detection equipment can be simple, cheap, and easily adapted to completely automatic operation in the field.

How it's done:

Several requirements were established for the system: The nuclide must be capable of fixation in a form easy to attach to the animal without danger of loss into or contamination of the environment. The radiation dose to the animal must be minimal, but system sensitivity should be high enough for positive detection at 1 m or more. The system must be capable of unattended operation in any weather, with checks required only weekly. Finally the system must provide positive indication regardless of the orientation or self-shielding of animals weighing 1 kg or more.

Selenium-75 was chosen as the nuclide; it is available at a high specific activity and low cost in a form easy to incorporate into epoxy resins. These resins adhere firmly to nearly any surface to form hard, nontoxic coatings that resist mechanical damage or leaching of the radionuclide. Since ^{75}Se decays by electron-capture, charged particles are not emitted and a high local skin dose is avoided.

The chief radiations (77- to 405-kev gamma rays) readily penetrate tissue with a half-value of about 7 cm and give high counting efficiency with a minimum gamma dose to the animal. The half-life of ^{75}Se (120 days) is long enough to minimize the overall dose to the animal and to limit the possibility of liberation of a long-lived radiation hazard into the environment.

Miniature GM tubes were selected for effective detection; they are inexpensive, rugged, and small enough for unobtrusive placement, with excellent sensitivity to ^{75}Se radiation. Their operating voltage (375 to 400 v) is low enough for an inexpensive battery supply; their pulse output is large enough to drive 15 m or more of coaxial cable; and their sensitivity is well adapted to the rugged and inexpensive multichannel, single-event recorders.

Encapsulation of the GM tube in resin, within a five-sided Pb shield, makes a rugged, sensitive, and weatherproof detector that is easily attached to weatherproof cable. The background count rate for these detectors is less than 1 min^{-1}. At 1 m, 50 μc of ^{75}Se, contained in a 1-kg tissue phantom, gives a count rate of 10 min^{-1}. The response follows the inverse-square law, so the same sample gives 110 min^{-1} at 30 cm and 1,000 min^{-1} at 10 cm. This capsule is placed on a bird band.

(continued overleaf)

A weatherproof enclosure, made of marine plywood, houses the electronic circuitry, recorder, and battery supply.

Reference:

N. A. Frigerio and W. J. Eisler, Jr., *Ecology* **49**(4) (1968).

Notes:

1. This information may interest persons and organizations concerned with animal behavior.
2. Inquiries may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B69-10286

Source: N. A. Frigerio and W. J. Eisler, Jr.
Biological and Medical Research Division
(ARG-10342)

Patent status:

Inquiries concerning rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439